PATENT ABSTRACTS OF JAPAN

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(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

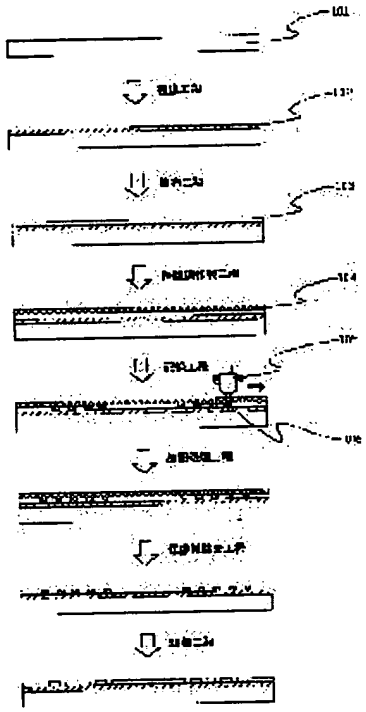
(72)Inventor : ABE SHINYA

54) INFORMATION RECORDING MEDIUM MASTER DISK AND METHOD FOR MANUFACTURING THE SAME

57)Abstract:

PROBLEM TO BE SOLVED: To provide a stable method for manufacturing a master disk by which deactivation of a photoresist by intrusion of a base material is suppressed even when a substrate containing a base material is used in the method for the manufacture of an information recording medium which uses a chemically amplifying photoresist.

SOLUTION: A non-basic and almost transparent barrier layer 102 which prevents intrusion of a base material is formed between the substrate containing a base and the chemically amplifying photoresist film used as a photosensitive material so as to isolate the photoresist film 103 from diffusion of the base material in the substrate.



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CLAIMS

[Claim(s)]
[Claim 1] Information record-medium original recording by which the laminating of the non-basicity ingredient film was carried out, and the desired pattern was formed with chemistry magnification mold photoresist resin on said non-basicity ingredient film on the base material.
[Claim 2] Information record-medium original recording according to claim 1 characterized by a base material being an alkali **** ingredient or soda glass.
[Claim 3] Information record-medium original recording according to claim 1 to which a non-basicity ingredient is characterized by being a silicon dioxide.
[Claim 4] Information record-medium original recording according to claim 1 to which a non-basicity ingredient is characterized by being an aluminum oxide.
[Claim 5] Information record-medium original recording according to claim 1 to which a non-basicity ingredient is characterized by being the organic polymer of nonaqueous solubility.
[Claim 6] The information record-medium original-recording production approach of becoming from the film-production process which forms the film of a non-basicity ingredient on a substrate, the spreading process which apply and carry out stoving of the chemistry magnification mold photoresist as a photosensitive ingredient, the record process which embrace the signal with which wavelength should record record light 300 nm or less, become irregular or deviate, and carry out condensing exposure, heating down stream processing after exposure, and the development process develop negatives in said chemistry magnification mold photoresist, and form a desired pattern.
[Claim 7] The information record-medium original recording production approach according to claim 6 that a non-basicity ingredient is characterized by being abbreviation transparence to the wavelength of record light.
[Claim 8] the wavelength of after a spreading process and record light -- receiving -- abbreviation -- the information record-medium original recording production approach according to claim 6 characterized by performing a development process after performing the protective coat production process which forms a water-soluble transparent ingredient by the thickness of 300nm or less and performing a record process and the protective coat removal process that a neutral water solution removes a water-soluble ingredient after heating down stream processing.
[Claim 9] The information record-medium original recording production approach according to claim 8 that a water-soluble ingredient is characterized by being an organic polymer.
[Claim 10] The information record-medium original recording production approach according to claim 8 characterized by heat-treating between the spreading process of a water-soluble ingredient, and a record process.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the production approach using a chemistry magnification mold photoresist as a photosensitive ingredient especially about the production approach of original recording for information record media, such as an optical disk.
[0002]
[Description of the Prior Art] Although an optical disk is general with the spread of compact disks (CD), researches and developments of a higher-density optical disk are done briskly, and DVD still higher-density than CD is proposed and put in practical use in recent years. Development of the further high density optical disk for recording the signal for which the large capacity of a high definition television will be needed from now on on high density is desired. For that purpose, the production technique of the high-density information record-medium original recording which can perform more detailed record is very important.
[0003] The spreading process which the conventional information record-medium original recording applies to the soda glass base material 201 the photoresist which used novolak resin as the principal component with a spin coat method as shown in drawing 2 , and forms the photoresist film 202, Blue glow (for example, wavelength of 458nm), or near ultraviolet ray light (for example, wavelength of 351nm) It becomes irregular or deviates according to the signal which should be recorded, and is produced by the record process condensed and exposed with an objective lens 203, and the development process which forms the pattern called a pit by developing negatives after that and removing the exposure section 204, and a slot.
[0004] In order to raise recording density, it is necessary to form a smaller pit and a narrow slot. For example, in DVD with the capacity of 4.7GB, the magnitude of the minimum pit is about 0.3 micrometers in die length of 0.4 micrometers, and width of face, and in order to attain the capacity of about 25GB, it needs to form die length of 0.18 micrometers, and an about [width-of-face 0.15micrometer] pit. In order for the magnitude of the pit formed to form a smaller pit depending on the diameter of a condensing spot of record light, the smaller diameter of a condensing spot is needed.
[0005] Generally, the diameter of a condensing spot is proportional to the wavelength of record light, and in inverse proportion to numerical aperture. However, if it says about numerical aperture, it is difficult to already have condensed using 0.9 or more objective lenses from the former, and to enlarge this further. Then, the attempt which makes the diameter of a condensing spot small by short wavelength-ization is made, using far-ultraviolet-rays light with wavelength shorter than 300nm as a record light.
[0006]
[Problem(s) to be Solved by the Invention] However, since this wavelength region shows big absorption, light energy is transformed into heat energy by absorption rather than the sensitization process which should happen essentially, a temperature up is carried out, the process in which it deteriorates occupies dominance and the function as a photoresist is lost, application in this wavelength region is difficult for the photoresist which uses as a principal component the novolak resin used from the former.
[0007] Then, application of the chemistry magnification mold photoresist which uses as a principal component the polyvinyl phenol (PVP) currently prepared for the excimer lasers of far ultraviolet rays, polymethylmethacrylate (PMMA), etc. is tried. However, although the solubilization reaction to an alkaline developer advances according to the luminous energy with which the conventional novolak resin photoresist was exposed, the proton (acid) generated with the exposed luminous energy serves as a catalyst, the solubilization to an alkaline developer is promoted by BEKU after exposure, and the configuration after final development is decided by the chemistry magnification mold photoresist by

t.
0008] Therefore, the trap of the proton generated when the base object invaded is carried out by neutralization, it leactivates, and the function as a catalyst is not accomplished, but it has the same effectiveness, and the configuration ormed in development changes as the sensibility of a photoresist changed as a result. Therefore, since itself contains a ase object, the soda glass conventionally used for the base material becomes the cause of it being spread in a hotoresist and causing deactivation of a proton similarly, when applying directly. Moreover, management of the base bject concentration which exists in an ambient atmosphere is needed.
0009] Moreover, from inner circumference, since exposure performs one by one toward inner circumference from a eriphery or a periphery, it occurs [time difference] at the start edge and termination of exposure. A sensibility change n the meantime poses a big problem as original recording of an information record medium in order to cause an nuniformity in the configuration after development.
0010] Then, even if conventional cheap soda glass is used for the purpose of this invention as a base material, it is ntercepting the base object which carries out diffusion invasion from a base material to a chemistry magnification mold hotoresist, preventing deactivation of a photoresist, and offering the approach which is stabilized and produces nformation record-medium original recording.
0011]
Means for Solving the Problem] Even if the information record-medium original recording production approach of this invention is a base material containing a base object, it is preparing the layer of the non-basicity ingredient which intercepts diffusion invasion of a base object between a base material and the chemistry magnification mold photoresist film used as a photosensitive ingredient, and a base object invades from a base material and it can prevent causing deactivation of a chemistry magnification mold photoresist. Moreover, the effectiveness that forming the protective coat of a non-basicity ingredient in a photoresist film front face also prevents the base object in an ambient atmosphere invading into a photoresist, and it prevents deactivation is acquired. In addition, a non-basicity ingredient here means the ingredient which the photoresist film is not made to diffuse a base object, and reacts with a photoresist and thinner, and does not generate a base object.
[0012]
[Embodiment of the Invention] Hereafter, the gestalt of the operation in the information record-medium original recording production approach of this invention is explained, referring to a drawing.
[0013] Drawing 1 is a schematic diagram explaining the information record-medium original recording production approach in the gestalt of operation of this invention. The transparence isolation layer 102 which consists of a silicon dioxide by chemical vapor deposition (CVD method) is first formed as a film production process on the soda glass base material 101 which finished surface washing. As a spreading process, a PVP system chemistry magnification mold photoresist is applied with a spin coat method, is heated, thinner is evaporated enough, and the photoresist film 103 is formed by the thickness of 70nm of abbreviation.
[0014] As a protective coat production process, the water-soluble polyvinyl system polymer (for example, TOKYO OHKA KOGYO TSP-5A) which is a non-basicity ingredient is applied with a spin coat method, it is made to dry and a protective coat 104 is formed. This water-soluble polyvinyl polymer does not contain a base object in itself, but reacts with a resist or the matter in atmospheric air, and does not generate a base object.
[0015] In addition, as for the thickness of a protective coat 104, it is desirable to make it 300nm or less so that it may be settled together with the thickness of the applied photoresist film in the depth of focus by which record light was condensed in the next record process. By the protective coat 104, the photoresist film 103 is isolated from an external ambient atmosphere, and it prevents the base object in an ambient atmosphere invading into the photoresist film 103.
[0016] Moreover, the silicon dioxide using the transparence isolation layer 102 is the covalent-bond object of oxygen and silicon, excluding a base, reacts with a photoresist and its thinner, and does not generate a base object. Therefore, it prevents the base object in the soda glass base material 101 spreading and invading into the photoresist film 103.
[0017] Moreover, as for the thickness of the transparence isolation layer 102, it is desirable to set up in consideration of the refractive index of the soda glass base material 101 to the record wavelength in a next record process, the refractive index of a protective coat and each photoresist, and thickness, so that the reflection factor of record light may become small.
[0018] Next, as a record process, it lets a protective coat 103 pass, and it condenses with an objective lens 105 and the far-ultraviolet-rays laser (wavelength of 248nm) using the 2nd higher harmonic of the Ar ion laser modulated or deflected according to the signal which should be recorded is exposed. In addition, it is desirable to heat-treat again, to diffuse the proton in a photoresist, and to make concentration distribution into homogeneity in front of a record process.
[0019] The alkali solubilization reaction of a photoresist is promoted by making the generated proton into a catalyst as

eating down stream processing after a record process. Next, pure water is poured as a protective coat removal process, otating a base material, and dissolution removal of the water-soluble protective coat is carried out. And after dissolving ne exposure section 106 with an alkaline developer, removing, rinsing with pure water again and flushing a developer s a development process, rotating a base material, information record-medium original recording with a pit pattern is roduced by making it rotate and making it shake off and dry.

0020] In addition, with the gestalt of this operation, although the silicon dioxide was used as an ingredient of a ransparence isolation layer, if the inorganic material of non-basicity covalent-bond objects, such as an aluminum oxide, lso reacts with a photoresist and thinner and does not generate a base object, it can use as an ingredient of a ransparence isolation layer, and the same effectiveness can be acquired. Moreover, effectiveness with the same said of he organic polymer (for example, AR2 made from SHIPUREI) of the nonaqueous solubility ingredient which reacts vith a photoresist and thinner and does not generate a base object can be acquired.

0021]

Effect of the Invention] According to the information record-medium original recording production approach of this nvention, even if it uses a chemistry magnification mold photoresist, it can prevent that a base object invades and carries out deactivation to a photoresist from a base material. Consequently, dispersion in the configuration for every riginal recording is suppressed, dispersion in the configuration within each original recording is also suppressed, and he stable information record-medium original recording can be produced.

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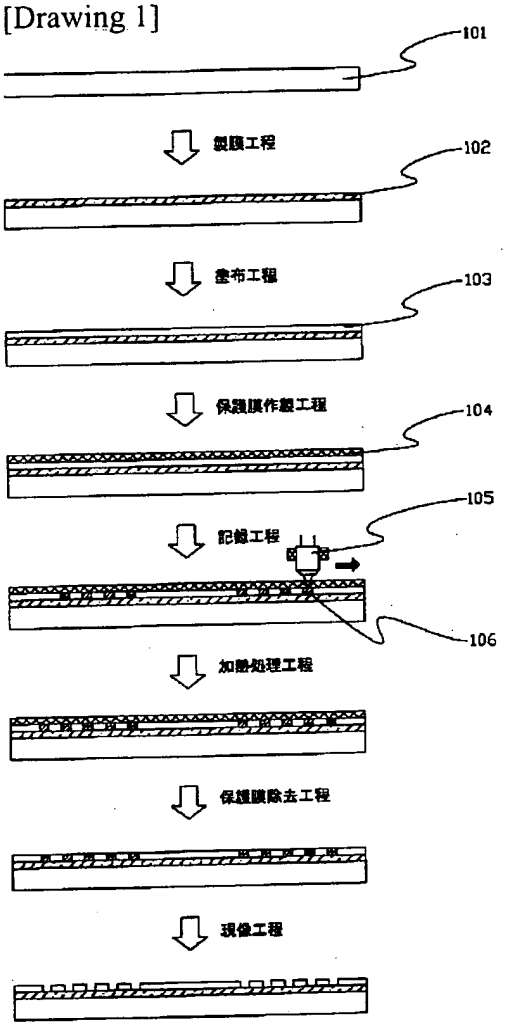
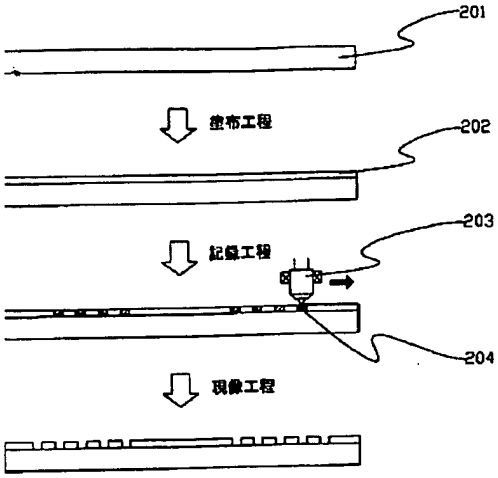
DRAWINGS

[Drawing 1]



[Drawing 2]



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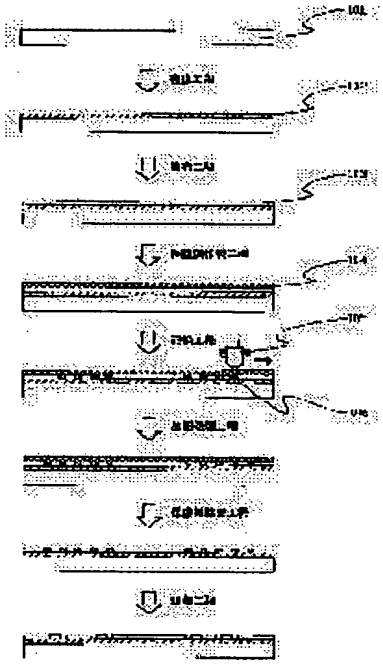

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Ｇ０３Ｆ	7/039	６０１	Ｇ０３Ｆ	7/039	６０１	５Ｄ１２１
	7/11	５０３		7/11	５０３	
// Ｇ０３Ｆ	7/038	６０１		7/038	６０１	

審査請求　未請求　請求項の数10　ＯＬ　（全４頁）

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(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地
(72)発明者　阿部　伸也
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(74)代理人　100097445
弁理士　岩橋　文雄　（外２名）

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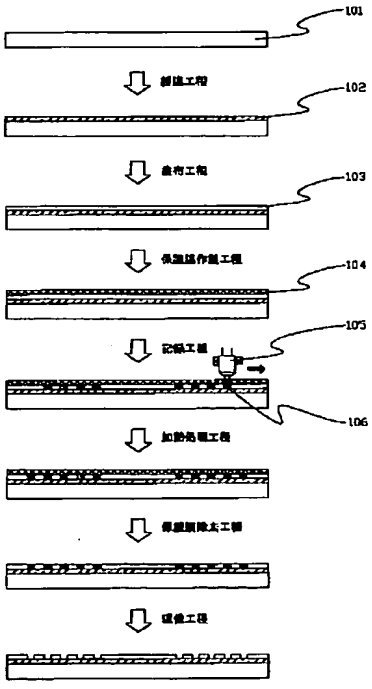
AD03 BE00 BG00 DA02 DA19
DA40 FA03 FA12 FA17
5D121 AA02 BA03 BA05 BB04 BB34
EE22 EE23 GG07

(54)【発明の名称】　情報記録媒体原盤とその作製方法

(57)【要約】
【課題】　化学増幅型フォトレジストを用いた情報記録媒体原盤の作製方法において、塩基物を含む基材を用いても塩基物の侵入によるフォトレジストの失活を抑えて、安定した原盤作製方法を提供する。
【解決手段】　塩基物を含む基材と感光性材料として用いる化学増幅型フォトレジスト膜の間に、塩基物が侵入することを防ぐ非塩基性の略透明な隔離層１０２を形成して、フォトレジスト膜１０３を基材中の塩基物の拡散から隔離する。



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【特許請求の範囲】

【請求項１】基材上に、非塩基性材料膜が積層され、前記非塩基性材料膜上に化学増幅型フォトレジスト樹脂により所望のパターンが形成された情報記録媒体原盤。

【請求項２】基材が塩基性物質含む材料あるいはソーダガラスであることを特徴とする請求項１記載の情報記録媒体原盤。

【請求項３】非塩基性材料が、二酸化珪素であることを特徴とする請求項１記載の情報記録媒体原盤。

【請求項４】非塩基性材料が、酸化アルミニウムであることを特徴とする請求項１記載の情報記録媒体原盤。

【請求項５】非塩基性材料が、非水溶性の有機ポリマーであることを特徴とする請求項１記載の情報記録媒体原盤。

【請求項６】基板上に非塩基性材料の膜を形成する製膜工程と、感光性材料として化学増幅型フォトレジストを塗布して加熱乾燥する塗布工程と、波長が３００ｎｍ以下の記録光を記録すべき信号に応じて変調または偏向して集光露光する記録工程と、露光後の加熱処理工程と、前記化学増幅型フォトレジストを現像して所望のパターンを形成する現像工程からなる情報記録媒体原盤作製方法。

【請求項７】非塩基性材料が記録光の波長に対して略透明であることを特徴とする請求項６記載の情報記録媒体原盤作製方法。

【請求項８】塗布工程の後、記録光の波長に対し略透明な水溶性材料を３００ｎｍ以下の厚みで形成する保護膜作製工程を行い、記録工程と加熱処理工程の後、中性水溶液で水溶性材料を除去する保護膜除去工程を行った後に、現像工程を行うことを特徴とする請求項６記載の情報記録媒体原盤作製方法。

【請求項９】水溶性材料が、有機ポリマーであることを特徴とする請求項８記載の情報記録媒体原盤作製方法。

【請求項１０】水溶性材料の塗布工程と記録工程の間で、加熱処理を行うことを特徴とする請求項８記載の情報記録媒体原盤作製方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は光ディスク等の情報記録媒体用原盤の作製方法に関するものであり、特に化学増幅型フォトレジストを感光性材料として用いる作製方法に関するものである。

【０００２】

【従来の技術】コンパクトディスク（ＣＤ）の普及にともない光ディスクは一般的なものとなってきたが、より高密度な光ディスクの研究開発が盛んに行われ、近年ではＣＤよりもさらに高密度なＤＶＤが提案され、実用化されている。今後高品位テレビといった大容量が必要とされる信号を高密度に記録するための更なる高密度光ディスクの開発が望まれている。そのためには、より微細

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な記録のできる高密度な情報記録媒体原盤の作製技術が非常に重要である。

【０００３】従来の情報記録媒体原盤は、図２に示すように、ソーダガラス基材２０１にノボラック樹脂を主成分としたフォトレジストをスピンコート法により塗布してフォトレジスト膜２０２を形成する塗布工程、青色光（例えば波長４５８ｎｍ）あるいは近紫外線光（例えば波長３５１ｎｍ）を、記録すべき信号に応じて変調または偏向し、対物レンズ２０３で集光して露光する記録工程、その後現像して露光部２０４を取り除くことによりピットと呼ばれるパターンや溝を形成する現像工程により作製される。

【０００４】記録密度を高めるには、より小さいピットや狭い溝を形成する必要がある。例えば、４．７ＧＢの容量を持つＤＶＤでは、最小ピットの大きさは、長さ０．４μｍ、幅０．３μｍ程度であり、２５ＧＢ程度の容量を達成するには、長さ０．１８μｍ、幅０．１５μｍ程度のピットを形成する必要がある。形成されるピットの大きさは、記録光の集光スポット径に依存し、より小さなピットを形成するには、より小さな集光スポット径が必要となる。

【０００５】一般的に集光スポット径は、記録光の波長に比例し、開口数に反比例する。しかし、開口数に関して言えば、従来から既に０．９以上の対物レンズを使って集光しており、これをさらに大きくすることは難しい。そこで、波長が３００ｎｍよりも短い遠紫外線光を記録光として用い、短波長化により集光スポット径を小さくする試みがなされている。

【０００６】

【発明が解決しようとする課題】しかしながら、従来から用いられてきたノボラック樹脂を主成分とするフォトレジストは、この波長域で大きな吸収を示し、本来起こるべき感光過程よりも、光エネルギーが吸収により熱エネルギーに変換されて昇温し、変質する過程が優勢を占め、フォトレジストとしての機能が失われるためこの波長域での適用が難しい。

【０００７】そこで、遠紫外線のエキシマレーザー用に用意されているポリビニルフェノール（ＰＶＰ）やポリメチルメタアクリレート（ＰＭＭＡ）等を主成分とする化学増幅型フォトレジストの適用が試みられている。しかし、従来のノボラック樹脂フォトレジストは、露光された光のエネルギーに応じてアルカリ性現像液への可溶化反応が進行するが、化学増幅型フォトレジストでは、露光された光のエネルギーにより発生するプロトン（酸）が触媒となって露光後のベークによってアルカリ性現像液への可溶化が促進され、最終的な現像後の形状が決まる。

【０００８】そのため、塩基物が侵入すると、発生したプロトンが中和反応によりトラップされて失活し、触媒としての機能を成さず、結果としてフォトレジストの感

度が変化したのと同じ効果を持ち、現像で形成される形状が変化する。そのため、従来基材に用いられてきたソーダガラスは、それ自体が塩基物を含むため、直接塗布する場合、フォトレジストに拡散して同様にプロトンの失活を起こす原因となる。また、雰囲気中に存在する塩基物濃度の管理が必要となる。

【０００９】また、露光は内周から外周あるいは外周から内周へ向かって順次行うため、露光の始端と終端では時間差が発生する。その間の感度変化は現像後の形状に不均一を引き起こすため、情報記録媒体の原盤としては大きな問題となる。

【００１０】そこで、本発明の目的は、従来の安価なソーダガラスを基材として用いても、基材から化学増幅型フォトレジストに拡散侵入する塩基物を遮断し、フォトレジストの失活を防いで、安定して情報記録媒体原盤を作製する方法を提供することである。

【００１１】

【課題を解決するための手段】本発明の情報記録媒体原盤作製方法は、塩基物を含む基材であっても基材と感光性材料として用いる化学増幅型フォトレジスト膜との間に塩基物の拡散侵入を遮断する非塩基性材料の層を設けることで、基材から塩基物が侵入し、化学増幅型フォトレジストの失活を起こすことを防止できる。また、フォトレジスト膜表面に非塩基性材料の保護膜を形成することでも、雰囲気中の塩基物がフォトレジストに侵入することを防ぎ、失活を防ぐ効果が得られる。なお、ここでいう非塩基性材料とは、フォトレジスト膜に塩基物を拡散させず、かつフォトレジストやシンナーと反応して塩基物を発生することが無い材料を意味する。

【００１２】

【発明の実施の形態】以下、本発明の情報記録媒体原盤作製方法における実施の形態について、図面を参照しながら説明する。

【００１３】図１は、本発明の実施の形態における情報記録媒体原盤作製方法を説明する概略図である。まず製膜工程として、表面洗浄を済ませたソーダガラス基材１０１上に、化学的気相成長法（ＣＶＤ法）により二酸化珪素からなる透明隔離層１０２を形成する。塗布工程として、ＰＶＰ系化学増幅型フォトレジストをスピンコート法により塗布し、加熱してシンナーを十分蒸発させて略７０ｎｍの厚みでフォトレジスト膜１０３を形成する。

【００１４】保護膜作製工程として、非塩基性材料である水溶性のポリビニル系ポリマー（例えば東京応化工業製ＴＳＰ－５Ａ）をスピンコート法により塗布し、乾燥させて保護膜１０４を形成する。この水溶性ポリビニルポリマーは、それ自身に塩基物を含有せず、レジストあるいは大気中物質と反応して塩基物を発生することもない。

【００１５】なお、保護膜１０４の膜厚は、塗布したフォトレジスト膜の膜厚と合せて、後の記録工程において記録光の集光された焦点深度内に収まるよう３００ｎｍ以下にするのが望ましい。保護膜１０４により、フォトレジスト膜１０３は外部雰囲気から隔離され、雰囲気中の塩基物がフォトレジスト膜１０３に侵入することが防がれる。

【００１６】また、透明隔離層１０２を用いた二酸化珪素は、酸素と珪素の共有結合体であり、塩基を含まず、またフォトレジストやそのシンナーと反応して塩基物を生成する事もない。そのため、ソーダガラス基材１０１中の塩基物がフォトレジスト膜１０３に拡散して侵入するのを防ぐ。

【００１７】また、透明隔離層１０２の膜厚は、後の記録工程での記録波長に対するソーダガラス基材１０１の屈折率と、保護膜、フォトレジストそれぞれの屈折率と膜厚を考慮して、記録光の反射率が小さくなるように設定するのが望ましい。

【００１８】次に、記録工程として保護膜１０３を通して、記録すべき信号に応じて変調または偏向されたアルゴンイオンレーザーの第２高調波を用いた遠紫外線レーザー（波長２４８ｎｍ）を対物レンズ１０５により集光して露光する。なお、記録工程の前に、再度加熱処理を施し、フォトレジスト中のプロトンを拡散させ、濃度分布を均一にするのが望ましい。

【００１９】記録工程後、加熱処理工程として、発生したプロトンを触媒としてフォトレジストのアルカリ可溶化反応を促進させる。次に保護膜除去工程として、基材を回転させながら純水をかけ、水溶性の保護膜を溶解除去する。そして、現像工程として、基材を回転させながらアルカリ性現像液により露光部１０６を溶解して除去し、再度純水で濯いで現像液を洗い流した後、回転させて振り切り乾燥させることにより、ピットパターンを持った情報記録媒体原盤を作製する。

【００２０】なお、本実施の形態では、二酸化珪素を透明隔離層の材料として用いたが、酸化アルミニウム等の非塩基性共有結合体の無機材料でも、フォトレジストやシンナーと反応して塩基物を発生することが無ければ、透明隔離層の材料として用いて同様の効果を得ることができる。また、フォトレジストやシンナーと反応して塩基物を発生しない非水溶性材料の有機ポリマー（例えばシプレイ製ＡＲ２）でも同様の効果を得ることができる。

【００２１】

【発明の効果】本発明の情報記録媒体原盤作製方法によれば、化学増幅型フォトレジストを用いても、基材から塩基物がフォトレジストに侵入して失活させることが防止できる。その結果、原盤ごとの形状のばらつきを抑え、各原盤内での形状のばらつきも抑えて、安定した情報記録媒体原盤が作製できる。

【図面の簡単な説明】

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【図１】本発明の実施の形態における情報記録媒体原盤作製方法を説明する概略図

【図２】従来の情報記録媒体原盤作製方法を説明する概略図

【符号の説明】

１０１　石英ガラス基材
１０２　透明隔離層
１０３　フォトレジスト膜

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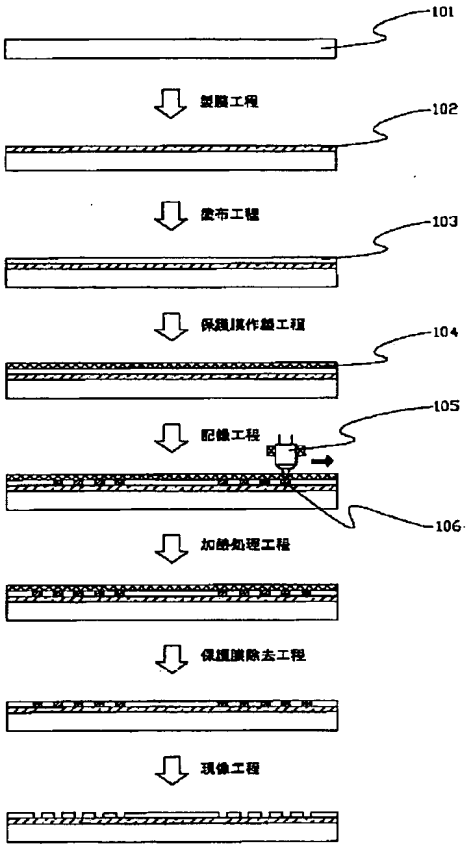
１０４　保護膜
１０５　対物レンズ
１０６　露光部
２０１　ソーダガラス基材
２０２　フォトレジスト膜
２０３　対物レンズ
２０４　露光部

【図１】



【図２】